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ELECTRIC POWER PRODUCTION ALONG THE KOREAN-MANCHURIAN BORDER

This report covers electric power installations at the border points of Sinuiju -- An-tung, Sup'ung -- T'ai-ping-kou, and Unbong -- Shangt'ao, which are used to transmit power from Korea to Manchuria.

Numbers in parentheses refer to appended sources.

Electric power produced on the Korean side of the Yalu and Tumen rivers is transmitted to Manchuria at a number of points along the border. A chart of transmission systems 22 kilovolts and above in the Western District of Korea, P'yongyang, undated shows six places where power lines cross over into Manchuria, as follows (1):

From (Korea)	Lat N	Long E	To (Manchuria)	Lat N	Long E
Sinuiju	40 06	124 23	An-tung	40 08	124 22
Sup'ung	40 27	124 56	T'ai-ping-kou	40 32	124 50
Unbong	41 22	126 32	Shang-t'ao	41 22	126 32
Sangsambong	42 41	129 47	Kai-shan-t'un	42 40	129 40
Namyang	42 58	129 51	T'u-men	42 50	129 50
Hunyung	42 54	130 13	Hun-ch'un	42 50	130 20

In Sinuiju there are a number of electric power transformer stations. Two of these, the No 1 and No 2 transformer stations, have lines crossing under the Yalu to An-tung, Manchuria. These two stations supplied a maximum of 10,500 kilovolt-amperes as of January 1948. This electric power is transmitted to

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Sinuiju from the Sup'ung Power Plant by two separate lines, namely, a 66-kilovolt line, which follows the course of the Yalu River, and a 220-kilovolt line which runs from Sup'ung in a southwest direction west of Chungdae-ri and east of Wonha-ri Switching Station.(1)

The Sup'ung area is the most important point of transmission of power into Manchuria. From the Sup'ung Power Plant at Sup'ung-dong, a 220-kilovolt line runs to Dairen and another 220-kilovolt line runs to T'ai-ping-kou, K'uan-tien, and Mukden. As of January 1948, the Sup'ung plant had a total installed capacity of 400,000 kilovolt-amperes from four 100,000-kilovolt-ampere generators.(1)

Further up the Yalu, the Unbong Transformer Station is located in Chasong-gun between Manp'o and Chasong. In 1948, Unbong had a maximum capacity of 1,300 kilovolt-amperes from two 750-kilovolt-ampere transformers.(1)

The Sangsambong Transformer Station, located on the Tumen River, is in Chongsong-gun. It had a capacity of 300 kilovolt-amperes in 1948 with three 100-kilovolt-ampere transformers.(1)

The Namyang Transformer Station, in Onsong-gun opposite the Manchurian town of T'u-men, had a capacity of 520 kilovolt-amperes in 1948 from two transformers.(1)

The Hunyung Transformer Station in Kyongwon-gun, located in the extreme northeastern part of Korea where the Tumen River makes a sharp bend to the south, had a capacity, in 1948, of 300 kilovolt-amperes from three transformers.(1)

Sinuiju -- An-tung

In Sinuiju there are a number of power stations, all of which draw their power from the Sup'ung Dam. Two power lines come into the Sinuiju area from the dam. A 66-kilovolt circuit runs from the Sup'ung Power Plant and passes through Ch'ongsongjin, Uiju, and Namsinuiju. From Namsinuiju the lines run to stations No 1 and 2 of Sinuiju proper, thence across the Yalu to An-tung.(1) This circuit follows rather closely the course of the Yalu River. The other, a 220-kilovolt circuit, is located further south of the Yalu, in a southwest direction. There are no intermediate stations on this line. The line passes to the west of Chungdae-ri, east of Chungda-ri Switching Station and west of Wonha-ri Switching Station, terminating at Tasa-do. A 66-kilovolt line runs from Tasa-do north to Namsinuiju and then to stations in Sinuiju.(2)

No 1 Transformer Station in Sinuiju

This station is located in the northeastern part of the old city, near the Choson Paper Plant, which is located east of the main railroad line between P'yongyang and Sinuiju.(3) This power substation is 7.185 kilometers from Sang-dan-dong, a village northeast of Sinuiju, and 4.750 kilometers from the No 2 Transformer Station, which is located in Minp'o-dong, a ward in the old part of the city. This ward is in the southwestern part of the city, near the Yalu River. The Namsinuiju Transformer Station is about 5 kilometers south of the No 1 station.(4)

There are two sets of transformers at this station. The first has a total capacity of 6,000 kilovolt-amperes consisting of three transformers rated at 2,000 kilovolt-amperes each. The transformers, installed outdoors, are connected in a delta-delta circuit with 22-kilovolt primaries and 3.3 kilovolt secondaries. They are of the self-cooling, 50 cycle-per-second, single-phase type and are manufactured by Hitachi.(5)

The second set has a total capacity of 6,000 kilovolt-amperes from three transformers rated at 2,000 kilovolt-amperes, 22/3.3 kilovolt each. They are connected in a delta-delta circuit and are outdoors. They are also of the self-cooling, 50-cycle-per-second, single-phase type. There is a fourth transformer, which is held in reserve. These transformers where manufactured by Mitsubishi. The station, therefore, has a total capacity of 12 000 kilovolt-amperes, from six transformers rated at 2,000 kilovolt-amperes each, with one transformer held in reserve.(5)

The above ratings are as of January 1948.(5) A source dated July 1948 gives the total output of the No 1 Transformer Station in Sinuiju as 3,500 kilovolt-amperes, with a capacity of 2,000 kilovolt per transformer.(4)

In July 1950 there were nine power lines from the No 1 Transformer Station in Sinuiju. Electric load variations on the lines are given in the table below.(6) (No figures were given for power lines to An-tung, the Choson Paper Plant, Minp'o-dong, and the electric light line to Sinuiju.)

	Kw-hr	Max Kw	Avg Kw
To Sangdan-dong	457,040	860	479
To No 2 Transformer Station in Sinuiju	153,100	340	192
Electric lights to Choson Paper Plant	258,333	--	--
From Namsinuiji, a 50-cycle-per-second line	625,788	970	622
No 2 main line from Chungang Transformer Station	367,830	1,980	495

No 2 Transformer Station in Sinuiju

This station is 4.750 kilometers west of the No 1 Transformer Station in Sinuiju. The line between these two stations is referred to as the Minp'o-dong Transmission Line.(4)

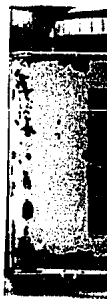
In January 1948, the No 2 Transformer Station in Sinuiju had a total capacity of 4,500 kilovolt-amperes from three transformers rated at 1,500 kilovolt-amperes, 22/3.3 kilovolt each. They are connected in a delta-delta circuit and are outdoors. They are self-cooling, 50-60 cycle-per-second, single-phase type, and were manufactured by Hitachi.(5)

In July 1948, this station had a maximum load demand of 2,600 kilovolt-amperes, which was provided by the three 1,500-kilovolt-amperes transformers.(4)

In July 1950, three power lines were connected to this station, with a total power consumption of 779,964 kilowatt-hours.(6)

Namsinuiju Transformer Station

This station is located about 5 kilometers south of the No 1 Transformer Station in Sinuiju.(4) It receives its power on a 66-kilovolt line from the Sup'ung Dam by way of Ch'ongsu, Ch'ongsongjin, and Uiju.(6)



As of January 1948 there were two sets of transformers at this station. The larger one had a total capacity of 4,500 kilovolt-amperes, from three transformers rated at 1,500 kilovolt-amperes, 66/22 kilovolt each. A fourth transformer is held in reserve. The transformers are connected in a delta-delta circuit and are installed outdoors. They are of the self-cooling, 60-cycle-per-second, single-phase type, and were manufactured by Hitachi.(5)

In January 1948, the smaller plant had a total capacity of 1,200 kilovolt-amperes, from three delta-delta connected transformers rated at 400 kilovolt-amperes, 22/3.3 kilovolt each. They are installed outdoors, and are self-cooling, 60-cycle-per-second, single-phase type manufactured by Fuji.(5) In July 1948, this station had a total capacity of 5,700 kilovolt-amperes from six transformers, with one in reserve.(4)

Chungang Transformer Station

The Chungang (Central) Transformer Station, in January 1948, had a total capacity of 15,000 kilovolt-amperes, provided by three delta-delta connected transformers rated at 5,000 kilovolt-amperes, 66/3.3 kilovolt each. They are outdoors, self-cooling, 60-cycle-per-second, single-phase type, manufactured by Snibaura.(5) The electric capacity figures for this station in July 1948 are the same as those given fc January of that year.(4)

In July 1950, eight lines were connected to this station. Electric load variations where given are as follows:

	Kw-hr	Max Kw	Avg kw
To No 2 main line to No 1 Transformer Station in Sinuiju	367,830	1,980	495
To Sinbang	3,031,900	760	408
To 3d main line	94,720	320	129
To 1st main line	320,980	850	434

Two 66-kilovolt lines enter the Chungang Transformer Station from Nagwon Switching Station.(6) One line is 6.5 kilometers. The wire is made of copper and aluminum alloy, six strands, 3.69 milimeters in total diameter. The wooden poles are of X-frame construction. The other line is 5.998 kilometers. The wire is 19-strand hard-drawn bare copper, 1.8 milimeters in diameter. The wooden poles are of H-construction.(4)

An-tung

In 1937, the An-tung Power Station had a total capacity of 18,500 kilovolt-amperes. A steam power plant, it operates at 50 cycles per second with 3,000 volts primary voltage and 100 volts secondary voltage.(7)

Details of power used in An-tung as of June 1937 are as follows (7):

	Number
Houses serviced by electric lights	18,597
Electric light bulbs	85,020

	Number
Industrial plants using electric power	518
Motors	11,816
Houses using electric heat	122
Heating units	221

An electric power plant is located in the southwestern part of An-tung, south of the railway bridges and south of the An-tung spinning mill.(3)

As early as 1937, electric power lines connected Sinuiju with An-tung. The length of the overland line between the two places is given as 1.656 kilometers. That part which is under water is 1.15 kilometers, making a total of 2.806 kilometers between the two stations. The lines are supported by 32 special metal towers and wooden poles. An additional line to Sinuiju from An-tung is 2.545 kilometers. A voltage of 22 kilovolt is used.(7)

One electric generator station in An-tung has a capacity of 3,700 kilovolt-amperes from two generators, one of which is held in reserve. The generators are of the three-phase, 50-cycle-per-second, 3,000-rpm type and were manufactured by Westinghouse.(7)

The other electric generator plant has a capacity of 6,250 kilovolt-amperes from two generators of the three-phase, 50-cycle-per-second, 3,000-rpm type and were manufactured by Mitsubishi.(7)

There are three steam boilers of the water tube type. The first has four drums. The heating surface is 663 square meters, with a steam pressure of 15 kilograms per square centimeter. All three boilers were manufactured by Babcock and Wilcox. The next plant has one drum with a heating surface of 760 square meters, with a steam pressure of 15 kilograms per square centimeter. The third plant has one drum with a heating surface of 760 square meters, with a steam pressure of 15 kilograms per square centimeter.(7)

Two steam turbines serve as prive movers in these power plants. One is a Westinghouse 3,000-kilowatt, 3,000-rpm, two-stage turbine with steam input, provided from two boilers, at a temperature of 370 degrees centigrade and a pressure of 13.5 kilogram/square centimeter. The other unit is a Mitsubishi 6,250-kilowatt, 3,000-rpm turbine with steam input, also provided from two boilers, at 307 degree centigrade and 13.5 kilogram/square centimeter.(7)

Sup'ung -- T'ai-ping-kou

The Sup'ung Power Plant and dam are located on the Yalu River about 70 kilometers northeast of Sinuiju. The plant is northeast of the village of Sup'ung-dong. This is one of a number of projects operating or proposed for the development of the Yalu River. Some of these proposed projects are at Uiju, Wiwon, Manp'o, Unbong, Chasong, and Chunggang.(8)

In January 1948, there were four generators at this plant (5), numbered 1, 2, 6, and 7. No 1 and 2 produce power for Manchuria, while No 6 and 7 provide northern Korea with power.(9) In January 1948, eight transformers were located here, with one held in reserve. These transformers, operating with 156-kilovolt primaries and 220-kilovolt secondaries, are grouped into two sets. The first set has a

total capacity of 400,000 kilovolt-amperes from four transformers rated at 100,000 kilovolt-amperes each. A fifth transformer is held in reserve. It is understood that primary windings are made lower deliberately compensate for the voltage drop in large units of this type.(5)

The transformers mentioned above are connected in delta-Y circuit and are installed outdoors. They are also of the water-cooled, 50-60-cycle-per-second, three-phase type.(5) The 50-cycle-per-second lines run into Manchuria, while the 60-cycle-per-second lines remain in Korea.(6)

The other set of transformers has a total capacity of 180,000 kilovolt-amperes from three transformers rated at 60,000 kilovolt-amperes which operate with 156-kilovolt primaries and 66-kilovolt secondaries. The transformers are connected in a delta-Y circuit and are outdoors. They are of the water-cooled, 60-cycle-per-second, three-phase type. One other transformer is held in reserve with this set. All nine transformers were manufactured by Shibaura. In January 1948, the total rated capacity for the nine transformers was 580,000 kilovolt-amperes.(5)

In July 1950, at least eight lines carried power from the Sup'ung Power Plant. Two transformers provided power for two 220-kilovolt lines to Manchuria. Two other transformers carry power from two 220-kilovolt power lines -- one to Tasa-do, the other to P'yongyang. A fifth transformer provided power for a 66-kilovolt line of 50-cycle frequency to Ch'ongsongjin, Uiju, and Sinuiju. A sixth transformer produced power for the Sup'ung dormitory for workers and the village of Sup'ung.(5) It also provided power for a factory in Sup'ung.(1) The seventh transformer produced power for two 66-kilovolt lines, one of which goes south to Sakju.

In July 1950, the seventh transformer supplied Sakju with 3,364,000 kilowatt-hours of power at a maximum load of 5,000 kilowatt and an average load of 3,419 kilowatt. The other 66-kilovolt line runs west to Ch'ongsu.(6)

The 220-kilovolt line to P'yongyang runs south 174.748 kilometers to the No 2 Transformer Station in P'yongyang. The wire on this line is made of 54 aluminum strands and seven steel strands, each strand being 2.82 milimeter in diameter.(9)

The two lines which go into Manchuria leave the power plant, which is located on the Korean side of the Yalu, and follow a northwestern course along the river. Available sources do not indicate the exact courses of these lines; however, they do show that two 220-kilovolt lines leave the Sup'ung Power Plant for Manchuria, one of which goes to Dairen.(10) The other one, after following the bend of the Yalu in a northern direction, then turns west to a place near Ch'ang-tien-ch'ang. It follows the railroad to T'ai-ping-kou and on up the railroad to K'uan-tien.(11)

Unbong -- Shang-t'ao

The Unbong Transformer Station, located southwest of Chasong, the county seat of Chasong County, and northeast of Manp'o, provided a maximum of 1,300 kilovolt-amperes in January 1948. Two 750-kilovolt-amperes, 66/3.3 kilovolt transformers are located there.(5)

These transformers, connected in an open-delta circuit, are installed outdoors. They are also of the self-cooling, 60-cycles-per-second, single-phase type, manufactured by Hitachi.(5) A 66-kilovolt power line runs from Kanggye in a northwestern direction to Sinjung and Manp'o. From Manp'o the line runs northeast to Unbong.(2)

50X1-HUM

Other charts place this transformer station at Samgang (N Lat 41 22, E Long 126 30) which is located west of Unbong. (1, 12) In July 1948, the total load demand of the Samgang station was reported to be 1,299 kilovolt-amperes, with two transformers rated at 750 kilovolt each. The line from Manp'o to Samgang, however, is called the Unbong Transmission Line. It is 36.836 kilometers long. The wire is of seven-strand hard-drawn copper, each strand being 2.6 millimeter in diameter. The line is carried on wooden poles.(12)

A chart drawn in 1937 shows a plan for an electric power plant in the vicinity of Unbong on the Yalu. It was listed as of No 3 priority, with an expected power output of 110,000 kilowatt.(8)

Shang-t'ao is a small Manchurian village west of Unbong. A ferry crosses the Yalu at Unbong. A road from the ferry goes a short distance to the west before it reaches Shang-t'ao. Thence it runs north, making a junction at Liang-min-tien-tzu (N Lat 41 24, E Long 126 30) through which runs a larger road following the course of the Yalu. Available sources do not indicate where the power line runs beyond Shang-t'ao. However, a chart drawn in 1937 shows an electric power station located at Hua-t'ung, a small Manchurian village located in the vicinity of Shang-t'ao.(8) From Hua-t'ung a power line runs south to Chi-an and then north to Hua-tong.(11)

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